REMARKS

Claims 1, 3 – 9, 12 – 21, 23 – 30, 32, and 33 are pending in the subject application, and all of the claims stand rejected. Favorable reconsideration of the application and allowance of all of the pending claims are respectfully requested in view of the following remarks.

Claims 1, 3, 12 – 21, 23, 30, 32, and 33 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Friedlander in view of any one of Russell, Aoki, Sullivan, Ghose, Spirtus, and Lidenblad. These claims are also rejected over these references in further view of Cranor. Further, claims 4 – 9 and 24 – 29 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Friedlander and any one of Russell, Aoki, Sullivan, Ghose, Spirtus, and Lidenblad in further view of Castella. Applicant respectfully traverses these rejections.

Independent claims 1, 13, 15, and 33 all relate to forming a transmit antenna beam with a phased array antenna comprising an array of antenna elements. These claims require computing a radiation shaping transformation as a function of the selected angular directions by constructing a plurality of vectors corresponding to the selected angular directions at which the nulls are to be located and computing a matrix whose product with each of the vectors is zero. Claim 14 even more particularly requires: selecting k angular directions at which nulls are to be located in an antenna transmission pattern of the phased array antenna; constructing k vectors v_n corresponding to selected antenna transmission pattern nulls; and computing an MxM matrix A of rank M-k that satisfies $Av_n = 0$ for $n = 1, \ldots, k$, where M is the number of antenna elements in the array. (also see dependent claims 3 (3/1) and 23 (23/15)).

Further, all of the independent claims require determining from the radiation shaping transformation an amplitude and phase distribution over the array of antenna elements that forms the transmit antenna beam with nulls of the antenna transmission pattern at the selected angular directions, wherein the amplitude and phase distribution is determined from the matrix.

Contrary to the Examiner's assertion, Friedlander does not disclose or suggest computing a matrix whose product with directional vectors is zero. The Examiner notes that Friedlander includes the equation: $D^H\mathbf{V_I} = 0$, presumably equating D^H with the claimed matrix. However,

D^H is not a matrix at all. Rather, Friedlander clearly discloses that D^H is a vector, more particularly, a "constant weight vector" (see the sentence between equations (5) and (6) of Friedlander). The fact that D^H is a vector and not a matrix as claimed can be appreciated from Friedlander's explanation of how this vector is determined and what it is used for in Friedlander's system. This is an important difference between Friedlander and the claimed invention. As can be understood from Applicant's disclosure, the claimed matrix is used to determine the amplitude and phase distribution over the array of antenna elements for transmission. Friedlander's vector D^H could not possibly provide this function, and more to the point, Friedlander does not disclose or suggest that the vector D^H is used to determine the amplitude and phase distribution, as claimed. In short, Friedlander's vector D^H is not a matrix as claimed, and does not perform the claimed function of the matrix.

Moreover, nothing in any of the cited secondary references would have suggested any obvious modification of Friedlander's scheme that would meet the limitations of the independent claims. The Examiner appears to argue that Cranor somehow suggests that Friedlander could be adapted to meet the claim limitations. Applicant respectfully submits that Examiner's arguments relating to Cranor are incorrect for a number of reasons. First, contrary to the Examiner's argument, amplitude and phase weighting are not equivalent or interchangeable, and the cited passage in Cranor most certainly does not suggest that amplitude and phase weighting are interchangeable. Cranor relates to combining separate multipath signals (not signals from different elements of an antenna array), and merely notes in the cited passage that a variety of different weighting schemes could be used to combine multipath signals. Not surprisingly, there is no statement or suggestion in Cranor that phase and amplitude weighting are in fact interchangeable. Thus, Cranor does not teach what the Examiner alleges.

Second, the differences between the claimed invention and Friedlander are much more profound than implied by the Examiner's argument. The Examiner appears to be assuming the Friedlander involves phase-only or amplitude-only weights, apparently suggesting that if Friedlander were extended to cover both phase and amplitude, then Friedlander's mere vector D^H would become a matrix as claimed. However, Friedlander does not teach or suggest anything

that supports this assumption. Specifically, nothing in Friedlander's disclosure expressly indicates that the system is phase-only or amplitude-only, and in any event there is no obvious modification that could be made to Friedlander's scheme based on Cranor's mention that one or both of amplitude and phase can be consider in combining multipath signals. In short, Friedlander's weight vector D^H is just that – a vector. Nothing in Cranor or any other reference suggests modifying Friedlander's scheme to perform computations involving a matrix instead of this vector. Moreover, nothing in Friedlander, Cranor, or any other reference suggest modifying Friedlander to use such a matrix to determine an amplitude and phase distribution over the array of antenna elements that forms the transmit antenna beam. A comparison of Applicant's technique and that of Friedlander reveals that the techniques are drastically different, and there is no obvious modification of Friedlander's system that would arrive at the claimed matrix.

As the Examiner acknowledges, Friedlander relates exclusively to signal reception while the claimed invention relates exclusively to signal transmission. Russell, Aoki, Sullivan, Ghose, Spirtus, and Lidenblad are all cited for a teaching that communication systems operate in two directions and "that interference that affects reception signals can affect transmission signals as well." The Examiner then goes on to explain that it would have been obvious to adapt Friedlander's system to shape transmission antenna beams since it would have been obvious to steer transmission nulls in the same direction as the reception nulls in the received signals so that the transmitted signals are not affect by interference. Respectfully, this reasoning is incorrect technically and does not support a case for obviousness. Every signal in a communication system is both transmitted and received: it is described as a transmitted signal when emitted by the transmitter and as a received signal upon being received by a far-end receiver. Interference is relevant only in the context of receiving a transmitted signal (a transmitted signal is interfered with only from the perspective of the receiver). When an antenna beam pattern is formed at the transmitter, essentially more energy is transmitted in certain directions than others, generally with the idea of sending as much energy toward a receiving antenna as possible while minimizing energy in other directions. However, the shape and directionality of the transmitted beam has no bearing whatsoever on the interference experienced by the receiver receiving that

transmitted beam. The interference comes from sources other than the transmitter. The receiver is at only one angle with respect to the transmitter and thus cannot "see" the shape of the transmitter's beam; the receiver receives only the energy sent in its direction by the transmitter. By definition, any signal transmitted by the transmitter that is received by the receiver is the signal of interest and not interference. In short, contrary to the Examiner's assertion, shaping the antenna beam pattern of a transmitted signal cannot possibly have any impact on the interference experienced by a receiver receiving the transmitted signal; thus, the Examiner's rationale for adapting Friedlander's system for signal transmission is incorrect. Thus, for all of the foregoing reasons, the Examiner is respectfully requested to reconsider and withdraw the rejections of Applicant's independent claims.

Further, Friedlander does not disclose or suggest computing an MxM matrix of rank M-k, where M is the number of antenna elements in the array. The Examiner notes that Friedlander has an array of some number of antenna elements, with some lesser number of nulls. While this may be so, Friedlander does not suggest the claimed MxM matrix of rank M-k. Recall that the Examiner has equated Friedlander's vector D^H with the claimed matrix. Friedlander does not disclose or suggest that vector D^H is an MxM matrix, and Friedlander certainly makes no mention of any matrix of rank M-k as claimed. Thus, for this additional reason, independent claim 14 and dependent claims 3 and 23 would not have been obvious from any combination of Friedlander and the other cited references. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejections of these claims.

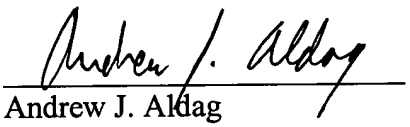
With regard to Castella (cited with respect to dependent claims 4-9 and 24-29), as previously noted, the portion of Castella relied upon by the Examiner relates to the receive antenna pattern. Castella clearly discloses in the Abstract that "[i]n the transmit mode unity amplitude weighting is desired so that all elements transmit the same power." In contrast, all of the independent claims require determining from a radiation shaping transformation an amplitude and phase distribution over the array of antenna elements that forms the transmit antenna beam. Moreover, the claims against which Castella is applied also require amplitude tapering of the antenna transmission pattern. Castella quite plainly teaches directly away from

amplitude tapering in transmit mode. Thus, Castella does not suggest the claimed amplitude tapering of a transmit signal as suggested by the Examiner. Accordingly, these dependent claims should be allowable for this additional reason.

In view of the foregoing, Applicant respectfully requests the Examiner to find the application to be in condition for allowance with claims 1, 3 – 9, 12 – 21, 23 – 30, 32, and 33. However, if for any reason the Examiner feels that the application is not now in condition for allowance, the Examiner is respectfully requested to call the undersigned attorney to discuss any unresolved issues and to expedite the disposition of the application.

Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this case, and any required fee for such extension is to be charged to Deposit Account No. 05-0460.

Respectfully submitted,



Andrew J. Aldag
Registration No. 40,483

EDELL, SHAPIRO & FINNAN, LLC
1901 Research Boulevard, Suite 400
Rockville, Maryland 20850-3164
(301) 424-3640

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